ABSTRACT

A method for fabrication of ceramic tantalum nitride and improved structures based thereon is disclosed. According to the disclosed method, an ionized metal plasma ("IMP") tool is used to create a plasma containing tantalum ions where the plasma is sustained by a mixture of nitrogen and argon gases. The percentage of nitrogen partial flow in the mixture of gases is adjusted so as to result in a layer of tantalum nitride with a nitrogen content of at least 30%. With a nitrogen content of at least 30%, the tantalum nitride becomes ceramic. The ceramic tantalum nitride presents a number of advantages. For example, the fabrication of ceramic tantalum nitride can be easily incorporated into fabrication of semiconductor chips using copper as the interconnect metal. Also, ceramic tantalum nitride can be used as an effective etch stop layer. The reason is that ceramic tantalum nitride does not react with fluoride which is a typical constituent of etchants utilized to etch silicon-based dielectrics such as silicon dioxide. Further, ceramic tantalum nitride can be used as a dielectric in fabrication of a capacitor stack using copper electrodes. Since fabrication of ceramic tantalum nitride is easily assimilated with fabrication of copper, the capacitor stack utilizing ceramic tantalum nitride can be built in a single IMP tool along with the copper electrodes. The result is higher throughput and a reduced risk of contaminating the semiconductor wafer since there is no need to "break vacuum" for a separate fabrication of the dielectric layer.